



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) Publication number:

**0 566 793 A1**

(12)

## EUROPEAN PATENT APPLICATION

(21) Application number: 92303850.9

(51) Int. Cl.<sup>5</sup>: C12Q 1/68

(22) Date of filing: 29.04.92

(30) Priority: 24.04.92 US 872265

(43) Date of publication of application:  
27.10.93 Bulletin 93/43

(84) Designated Contracting States:  
AT BE CH DE DK ES FR GB GR IT LI LU MC  
NL PT SE

(71) Applicant: IOWA STATE UNIVERSITY  
RESEARCH FOUNDATION, INC.  
214 O&L Building  
Ames, Iowa 50011(US)

(72) Inventor: Beitz, Donald C.  
2701 Pierce  
Ames, Iowa 50011(US)  
Inventor: Freeman, Albert E.  
1907 Northwestern  
Ames, Iowa 50011(US)  
Inventor: Schutz, Michael M.  
Apt. 11,  
13174 Larchdale Road  
Laurel, Maryland 20708(US)  
Inventor: Lindberg, Gary L.  
Rt. 4,  
Prairie Ridge  
Ames, Iowa 50010(US)

(74) Representative: Thomson, Paul Anthony  
Potts, Kerr & Co.  
15, Hamilton Square  
Birkenhead Merseyside L41 6BR (GB)

(54) Association of bovine mitochondrial DNA with traits of economic importance.

(57) A method of genetically evaluating animals by using mitochondrial DNA is disclosed. Polymorphisms in mitochondrial DNA are detected by isolating, fragmenting, and sequencing the DNA. The restriction patterns and nucleotide sequences of mitochondrial DNA of different animals are correlated to expressed traits in the animals. This may be confirmed by comparing results to expression of the trait in maternal lineages of animals. Further, effects of maternal lineages are determined by partitioning maternal genetic variation from nuclear variation.

EP 0 566 793 A1

such as high milk production.

Another application is choice of cows from the best maternal lineages (cytoplasmically or mitochondrially based), as donors for embryo transplants. The practice of embryo transplantation is used extensively in the dairy industry.

Thus, it is apparent that the invention accomplishes at least all of its objectives.

#### Claims

1. A method of determining the phenotypic effects of mitochondrial DNA polymorphism in dairy cattle comprising (a) detecting said polymorphism in mitochondrial DNA of said animals; and (b) associating nucleotide sequences of mitochondrial DNA to traits of economic importance.
2. A method as claimed in claim 1, comprising associating nucleotide sequences of mitochondrial DNA to milk production traits.
3. A method as claimed in claim 2, characterised in that polymorphisms at site 16074 and at sites 16058, 16085, 16230 and 16247 are associated with milk production.
4. A method as claimed in claim 1, further comprising fragmenting and sequencing mitochondrial DNA of said animals.
5. A method as claimed in claim 1, characterised in that polymorphism at bp 169 and 16058 are associated with days open and reproductive costs.
6. A method as claimed in claim 1, characterised in that polymorphism within the mitochondrial DNA is the D-loop sequence.
7. A method as claimed in claim 4, further comprising comparing said sequences of mitochondrial DNA of said animals to sequences of mitochondrial DNA of another animal to detect polymorphisms.
8. A method as claimed in claim 7, characterised in that phenotypic expression of a trait is correlated to said polymorphism in mitochondrial DNA.
9. A method of genetic evaluation of dairy cattle comprising sequencing mitochondrial DNA fragments of said dairy cattle and associating the expression or absence of a milk production traits in said dairy cattle with the presence or absence of said mitochondrial DNA fragments.
10. A method of evaluating inheritable milk production traits and health in dairy cattle by partitioning effects of mitochondrial lineages from nuclear effects, comprising isolating mitochondrial DNA from a group of said dairy cattle, fragmenting and sequencing said mitochondrial DNA, comparing said mitochondrial DNA of said group of dairy cattle to detect nucleotide sequence polymorphism and correlating said polymorphic mitochondrial DNA sequences with a milk production trait of said dairy cattle.